UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

September 28, 2007

MEMORANDUM

SUBJECT: Review of "*Determination of Removal Efficiency of Permethrin (PER) from Hand Surfaces Using DSS and Isopropyl Alcohol Dressing Sponges*"

FROM: Jeff Evans, Biologist
Health Effects Division (HED)/Chemistry and Exposure Branch (7509P)

THRU: Dana Vogel, Chemist
Health Effects Division/Chemistry and Exposure Branch (7509P)

TO: **Cathryn O'Connell**
Special Review and Reregistration Division (7508P)

DP Barcode: 336772
PC Codes: Permethrin (109701), PBO (067501)
MRID: 46188631

Attached is a review of MRID 46188631 "*Determination of Removal Efficiency of Permethrin (PER) from Hand Surfaces Using Isopropyl Alcohol Dressing Sponges*" submitted by the Non-Dietary Exposure Task Force (NDETF).

The primary review for this study was conducted by Versar and is included as Attachment (1). A secondary review was conducted by the Health Effects Division (HED).

The purpose of the study was to perform preliminary method validation trials for determining residue concentrations of permethrin (PER) on bare hands after being spiked with known amounts of PER. The hand wipe method selected by the NDETF is based on techniques described in Geno et al., 1996 demonstrating a high degree of pesticide residue removal efficiency when performing 2 sequential hand wipes with IPA moistened surgical sponges. The data presented in this trial are meant to be used as a method validation to support its use in other NDETF trials involving the collection of hand residues following contact with carpets and vinyl tiles treated with permethrin.

The study was conducted at the Toxcon Health Sciences Research Centre in Edmonton, Alberta, Canada. The analytical procedures were performed at EN-CAS Analytical Laboratories in Winston-Salem, NC. A formulation of PER (0.767% wt/wt) was developed by NDETF member McLaughlin Gormley King (MGK) for use the hand spiking/wipe method validation trial. The formulation was developed to simulate pesticide concentrations that may result from hand contact with post application residues after the use of a total release fogger product containing 0.76% PER.

Five subjects were recruited for the trial agreeing to have both hands (palms) spiked with (on separate occasions) 3 fortification levels of PER Prior to spiking, the subjects washed their hands with Ivory soap, followed by a tap water rinse and drying with paper towels. Aliquots having concentrations of 2.19 µg, 21.7 µg, and 65.7 µg of PER in 25 or 35 µl of IPA were applied to the palmar surfaces of the subjects' hands and allowed to dry for 30 minutes before the wipe method was performed. The dressing sponges were extracted and analyzed for PER by using a gas chromatograph equipped with and electron capture detector (GC/ECD). The removal efficiency (percent) for each spiking concentration is presented in the following table. The residues collected by the dressing sponges were not adjusted for field or laboratory recoveries since the recoveries were greater than 90%.

PER Fortification (spike) level (µg)	Percent Removed
2.19	82
21.7	76
65.7	76

As presented in the table above, sequential wipes with IPA removed the majority of residues from the subjects' hands. However, the NDETF results are not as efficient as described by Geno et al., 1996. It is recommended that the data in other trials relying on alcohol wipes be corrected to account for efficiencies less than 100 percent.

The specific limitations of this study identified in the primary review performed by Versar such as not providing information regarding the climate conditions at the Toxcon facilities are not significant overall conclusions of the study.

Reference:

Geno P.W., Camann D.E., Harding H.J., Villaboss K., Lewis R.G., (1996) Handwipe Sampling and Analysis Procedure for the Measurement of Dermal Contact with Pesticides. Arch Environ. Contam. Toxicol. 30: 132-138.

Attachment

MEMORANDUM

TO:	Margarita Collantes	cc:	110082.4000.001.01
FROM:	Kelly McAloon/Linda Phillips		
DATE:	April 2, 2004		
SUBJECT:	Review of "*Determination of Removal Efficiency of Permethrin (PER) from Hand Surfaces Using Isopropyl Alcohol Dressing Sponges*" (Project #: 02-021-PY01)		

This report reviews a study entitled "*Determination of Removal Efficiency of Permethrin (PER) from Hand Surfaces Using Isopropyl Alcohol Dressing Sponges.*" The protocol provided with the study along with OPPTS Series 875 Part B, Guideline 875.2300: Indoor Surface Residue Dissipation, Postapplication and Part C Guidelines were used to review the study.

Reviewers: Kelly McAloon/Linda Phillips **Date: April 2, 2004**

STUDY TYPE: Active Transfer; Hand

TEST MATERIAL: The test substance was a pre-fill emulsion similar to that used in the preparation of indoor foggers

SYNONYMS: Permethrin (PER)

CITATION:

Author/Study Director:	Sami Selim, Ph.D.
Title:	*Determination of Removal Efficiency of Permethrin (PER) from Hand Surfaces Using Isopropyl Alcohol Dressing Sponges*
Report Date:	October 1, 2003
Testing Facility:	Toxcon Health Sciences Research Centre, Inc. 9607 - 41 Avenue Edmonton, Alberta Canada T6E 5X7
Analytical Facility:	EN-CAS Analytical Laboratories 2359 Farrington Point Drive Winston-Salem, NC 27107
Identifying Codes:	Toxcon Study No.: 02-021-PY01 EN-CAS Project No.: 02-0027

SPONSOR: Non-Dietary Exposure Task Force

EXECUTIVE SUMMARY:

This report reviews "*Determination of Removal Efficiency of Permethrin (PER) from Hand Surfaces Using Isopropyl Alcohol Dressing Sponges*" submitted by the Non-Dietary Exposure Task Force. The purpose of the study was to determine the total amount of PER residues that can be removed from the hand surface following a single application of the pre-fill emulsion formulation containing 0.767% PER.

Five qualified subjects participated in the study. The formulated product was diluted in isopropyl alcohol (IPA) to concentrations of 2.19, 21.7 and 65.7 µg PER in 25 or 35 µL, applied directly to the washed hands of the test subjects, and allowed to dry for 30 minutes. Following the drying time, the hands of the subjects were then wiped with two dressing sponges wetted with 5 mL of IPA.

Total hand PER residues and removal efficiencies were calculated by the study author for each hand of the test subjects. PER residues removed from the hands ranged from 1.53 to 2.32 µg/sample with a mean value of 1.80 ± 0.21 µg/sample at the 2.19 µg fortification level, from 15.1 to 17.2 µg/sample with a mean value of 16.4 ± 0.589 µg/sample at the 21.7 µg fortification level, and from 46.8 to 51.8 µg/sample with a mean value of 49.7 ± 1.79 µg/sample at the 65.7 µg fortification level. Removal efficiencies averaged 82.2%, 75.4%, and 75.6% at the 2.19 µg, 21.7 µg, and 65.7 µg fortification levels, respectively. The overall average removal efficiency was 77.7 ± 6.52%. Versar did not have to correct the data, as all field fortification recoveries were >90%.

The protocol provided with the study along with OPPTS Series 875 Part B, Guideline 875.2300: Indoor Surface Residue Dissipation, Postapplication and Part C Guidelines were used to review the study. Overall, the majority of the procedures performed and the quality of the data generated in this study conformed to the criteria set forth in the protocol and guidelines. However, certain issues of concern were noted:

The test product was not identified and no product label was provided.

None of the test conditions (temperature, barometric pressure, ventilation) were reported.

The study author calculated residues based on the amount removed from the hand by the dressing sponges. The size of the test subject's hands were not reported to determine the amount removed per surface area.

Information on storage stability was not provided in the Study Report.

COMPLIANCE:
Signed and dated GLP, Quality Assurance and Data Confidentiality statements were provided. The study sponsor waived claims of confidentiality within the scope of FIFRA Section 10 (d)1(A), (B), or (C). The Study Report indicated that the study was conducted under EPA Good Laboratory Practice Standards (40 CFR Part 160), with the following exception: information recorded on subject entry, exit and hand inspection forms was not entered and/or corrected according to GLP Regulations.

GUIDELINE OR PROTOCOL FOLLOWED:
The study was reviewed using OPPTS Test Guidelines Series 875, Occupational and Residential Exposure Test Guidelines, Group B: 875.2300. The study was conducted following EN-CAS and Toxcon Standard Operating Procedures and the protocol of the Non-Dietary Exposure Task Force (Toxcon Protocol No. 02-021-PY01).

I. MATERIALS AND METHODS

A. Materials:

1. Test Material:

Formulation:	An unidentified pre-fill emulsion similar to that used in the preparation of indoor foggers, developed by McLaughlin Gormley King Company (MGK); contains PER (0.767% ai) as the active ingredient.
Lot/Batch # formulation:	GLP-1620
Formulation guarantee:	Certificate of Analysis provided.
CAS #(s):	PER: 52645-53-1
Other Relevant Information:	Toxcon ID No.: PY01T014

2. Relevance of Test Material to Proposed Formulation(s):

PER is the active ingredient used in formulated consumer products intended for use in residential buildings. The product used was a pre-fill emulsion similar to that used in the preparation of indoor foggers developed by McLaughlin Gormley King Company (MGK). The name and label for the test product was not provided with the study.

B. Study Design:
There were two amendments to the protocol. The amendments were as follows: 1) the lot number for the reference substance was changed from 15363 to 15365 (typographical error), and (2) the sponsor representative and submitter for the Non-Dietary Exposure Task Force was changed to David J. Carlson.

1. Site Description:

Test locations:	Not applicable to the study. The test product was applied directly to the hands of five test subjects.
Meteorological Data:	Not reported.
Ventilation/Air-Filtration:	Not reported.

2. Surface(s) Monitored:

Room(s) Monitored:	Not applicable to this study.
Room Size(s):	Not applicable to this study.
Types of Surface(s):	Hand surfaces (palms) of five test subjects.
Surface Characteristics:	The subjects' hands were washed with liquid Ivory soap, rinsed with water, and dried with a paper towel approximately 5 minutes before application of the formulated product.
Areas sprayed and sampled:	The diluted formulated product was applied directly to the palms of the washed hands of the test subjects. The hands were sampled with dressing sponges wetted with IPA to determine the amount of compound that could potentially be transferred from the hand to the mouth.
Other products used:	None

3. Physical State of Formulation as Applied : Liquid

4. Application Rates and Regimes:

Application Equipment:	The diluted formulation was pipetted directly to the hands using 25 µL or a combination of a 25 µL or 10 µL Wiretrol micropipettes.
Application Regime:	Each test concentration of the diluted product was applied to the washed palms of 10 hands (5 test subjects) and allowed to dry for 30 minutes before being wiped with the dressing sponges.
Application rate(s):	The formulation was diluted with IPA to concentrations of 2.19 µg, 21.7 µg, and 65.7 µg of PER per 25 µL or 35 µL of isopropyl alcohol.
Equipment Calibration Procedures:	Not applicable to this study.
Was total deposition measured?	Not applicable to this study.

D. Sampling:

Surface Areas Sampled:	The palms of five test subjects (male and female) were sampled; however, the surface area measurement of their hands was not reported.
Replicates per sampling interval:	Both hands of the five test subjects were sampled at three application levels (10 replicates per application level; 30 total replicates).
Number of sampling intervals:	There was one sampling interval for each concentration. Sampling was conducted approximately 30 minutes after the test substance was applied to the hands.
Method and Equipment:	The hand wipe was conducted using two 4" x 4" 6-ply dressing sponges.

Sampling Procedure(s):

Hand residues-	The removal of the test substance was conducted 30 minutes following application of the test substance. Five test subjects (ten hands) were used. The hand wipe consisted of wiping the palm of the hand with 4" x 4" 6-ply dressing sponges. About 5 mL of IPA was added to each dressing sponge prior to use. Two dressing sponges were used per hand. The hand wipe procedure is described in Toxcon SOP M-023.

3. Sample Handling and Storage:

The dressing sponges were placed in separate pre-labeled 180 mL amber glass jars with Teflon lids and stored in the dark at less than -10°C until being shipped to the analytical laboratory. Sample storage and shipment were conducted according to Toxcon Nos. G-022 *Storage of Test Samples and Analytical Extracts* and G-028 *Test Sample Distribution to a Contract Laboratory*. Samples were shipped to the analytical laboratory by airfreight with priority overnight delivery. Samples were shipped in an insulated cooler with dry ice.

IV. ANALYTICAL METHODOLOGIES

A. Extraction method:

Dressing sponges:	PER was extracted from the dressing sponges by shaking with 70:30 hexane:acetone for approximately 30 minutes on a mechanical shaker. Evaporative concentration was used for the field and laboratory controls as well as the LOQ fortifications to bring the PER residues into the linear region of the calibration curves. A 1 mL aliquot of the final extract was transferred to a labeled autoinjector vial containing dimethyldichlorosilane (DMDCS), which was added to compensate for matrix effects.

B. Detection methods:

The two isomers (cis and trans) of PER were separated by GC using a DB-5 column. Two distinct peaks were detected by electron capture detection, summed, and total PER was then quantitated on one curve.

D. Method Validation:

The analytical methods were validated in a previous study. The Study Report states that validation data for the limits of quantitation (LOQ) are reported in EN-CAS Project No. 01-0038, entitled *Permethrin (PER) and Piperonyl Butoxide (PBO) Validation Study: the Determination of PER and PBO in/on 2-Propanol (IPA) Moistened Dressing Sponges*. The limit of quantitation (LOQ) was reported to be 0.200 µg for PER.

Instrument performance and calibration: Calibration solutions were prepared from a 1000 µg/mL PER stock solution. Five solutions were prepared at concentrations of 0.005 µg/mL, 0.01 µg/mL, 0.02 µg/mL, 0.05 µg/mL, and 0.10 µg/mL. The GC responses were determined using the prepared calibration standards to perform a linear regression analysis.

E. Quality Control:

Lab Recovery: To obtain recovery and method performance data, concurrent laboratory control dressing sponge samples were fortified with the formulated product at four concentrations: 0.209, 2.09, 20.9, and 62.8 µg/sample. Results from the laboratory fortified samples are summarized in Table 1. Overall average recoveries were 98.7 ± 7.03%.

Table 1. Summary of Concurrent Laboratory PER Fortification Recoveries

Matrix	Fortification level (µg)[1]	Measured Residue (µg/sample)	Percent Recovery (%)	Overall Average Recovery (%)	Std Dev.	% RSD
Dressing Sponges	0.209	0.193	92.3	98.7	7.03	7.12
		0.228	109			
		0.221	106			
	2.09	1.95	93.3			
	20.9	19.7	94.4			
	62.8	61.1	97.3			

[1] Fortification levels were ~1x, ~10x, ~100x, and ~300x the LOQ.

Field Fortification: Diluted formulated product (25 µL or 35 µL) was directly applied to a triplicate set of two dressing sponges that had been wetted with IPA to yield an amount of 2.19, 21.7, and 65.7 µg PER per each set of dressing sponges. These samples were placed in a glass jar and stored frozen prior to shipment to the analytical laboratory. Field fortification results are summarized in Table 2. Overall average recoveries were 92.7 ± 2.17%.

Table 2. Summary of PER Field Fortification Recoveries

Matrix	Fortification level (µg)	Measured Residue (µg/sample	Percent Recovery (%)	Average Percent Recovery (%)	Overall Average Recovery (%)	Std Dev.	%RSD
Dressing sponges	2.19	2.05	93.6	94.8	92.7	2.17	2.34
		2.13	97.3				
		2.05	93.6				
	21.7	19.6	90.3	90.6			
		19.8	91.2				
		19.6	90.3				
	65.7	61.6	93.8	92.7			
		60.4	91.9				
		60.8	92.5				

[1] Fortification levels were at ~10x, ~100x, and ~300x the LOQ.

Control Samples: Field controls and blank laboratory controls were run with the experimental samples. The field controls were prepared by applying 35 µL of IPA to a quadruplicate set of two dressing sponges that had been wetted with 5 mL IPA and placed in glass jars. All concurrent laboratory and field control samples for the dressing sponges had no apparent PER residues observed at or above the LOQ.

Storage Stability: The Study Report did not mention if a storage stability study was conducted.

V. RESULTS

Field fortification recoveries were all >90%; therefore, the data did not need to be corrected. Residues were reported for low (2.19 µg PER), intermediate (21.7 µg PER) and high (65.7 µg PER) fortification levels.

A. Hand Residues

Total hand PER residues and removal efficiencies were calculated by the study author for each hand of the test subjects. PER residues removed from the hands ranged from 1.53 to 2.32 µg/sample with a mean value of 1.80 ± 0.21 µg/sample at the low fortification level, from 15.1 to 17.2 µg/sample with a mean value of 16.4 ± 0.589 µg/sample at the intermediate fortification level, and from 46.8 to 51.8 µg/sample with a mean value of 49.7 ± 1.79 µg/sample at the high fortification level. Removal efficiencies averaged 82.2%, 75.4%, and 75.6% at the low, intermediate, and high fortification levels, respectively. The overall average removal efficiency was 77.7 ± 6.52%. Versar did not have to correct the data, as all field fortification recoveries were >90%.

VI. CONCLUSION

Samples analyzed in this study were used to measure the removal efficiency of PER from bare hands to which a known amount of formulated product had been applied. The study author calculated residues based on the amount removed from the hand by the dressing sponges. The removal efficiency of PER from the test subjects' hands by the dressing sponges wetted with IPA was 77.7 ± 6.52%. Versar did not have to correct the data, as all field fortification recoveries were >90%.

LIMITATIONS OF THE STUDY:

The protocol provided with the study along with OPPTS Series 875 Part B, Guideline 875.2300: Indoor Surface Residue Dissipation, Postapplication and Part C Guidelines were used to review the study. Overall, the majority of the procedures performed and the quality of the data generated in this study conformed to the criteria set forth in the protocol and guidelines.

The test product was not identified and no product label was provided.

None of the test conditions (temperature, barometric pressure, ventilation) were reported.

The study author calculated residues based on the amount removed from the hand by the dressing sponges. The size of the test subjects' hands were not reported to determine the amount removed per surface area.

Information on storage stability was not provided in the Study Report.

Table 5. Summary of PER Dressing Sponge Results from Hand Sampling

Replicate	Fortification Level (µg)	Residue Found (µg)	Removal Efficiency (%)
12L	2.19	1.88	85.8
12R		1.79	81.7
22L		1.82	83.1
22R		1.72	78.5
32L		1.65	75.3
32R		2.32	105.9
42L		1.77	80.8
42R		1.74	79.5
52L		1.78	81.3
52R		1.53	69.9
Mean		1.80	82.2
SD		0.21	9.43
120L	21.7	16.9	77.9
120R		16.3	75.1
220L		17.2	79.3
220R		15.8	72.8
320L		16.2	74.7
320R		16.7	77.0
420L		16.5	76.0
420R		16.4	75.6
520L		16.6	76.5
520R		15.1	69.6
Mean		16.4	75.4
SD		0.589	2.71
160L	65.7	49.6	75.5
160R		50.3	76.6
260L		51.5	78.4
260R		50.5	76.9
360L		49.4	75.2
360R		51.3	78.1
460L		47	71.5
460R		46.8	71.2
560L		51.8	78.8
560R		48.4	73.7
Mean		49.7	75.6
SD		1.79	2.72
Overall mean			77.7
SD			6.52